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HDP/SB/21 based on PTO/SB/21 (08-00)

OIPE JUL 14 2005 PATENT & TRADEMARK OFFICE

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/764,072
Filing Date	January 19, 2001
Inventor(s)	Hisham S. ABDEL-GHAFFAR
Group Art Unit	2115
Examiner Name	Mark A. Connolly
Attorney Docket Number	29250-000502/US

ENCLOSURES *(check all that apply)*

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [ ] Amendment
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
- [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Assignment Papers *(for an Application)*
- [ ] Letter to the Official Draftsperson and _____ Sheets of Formal Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] After Allowance Communication to Group
- [ ] LETTER SUBMITTING APPEAL BRIEF AND APPEAL BRIEF (w/clean version of pending claims)
- [x] Appeal Communication to Group *(Notice of Appeal, Brief, Reply Brief)*
- [ ] Proprietary Information
- [ ] Status Letter
- [ ] Other Enclosure(s) *(please identify below)*:

Remarks

Mail Stop Appeal Brief-Patent

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	Harness, Dickey & Pierce, P.L.C.	Attorney Name Gary D. Yacura	Reg. No. 35,416
Signature	[signature]		
Date	July 14, 2005		

PTO/SB/17 (12-04)
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FEE TRANSMITTAL for FY 2005

Effective 10/01/2004. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 950

OIPE JC98 JUL 14 2005 PATENT & TRADEMARK OFFICE

Complete if Known	
Application Number	09/764,072
Filing Date	January 19, 2001
First Named Inventor	Hisham S. ABDEL-GHAFFAR
Examiner Name	Mark A. Connolly
Art Unit	2115
Attorney Docket No.	29250-000502/US

METHOD OF PAYMENT *(check all that apply)*

☒ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☐ Deposit Account:

Deposit Account Number: 08-0750

Deposit Account Name: Harness, Dickey & Pierce, PLC

The Director is authorized to: *(check all that apply)*
☐ Charge fee(s) indicated below ☐ Credit any overpayments
☐ Charge any additional fee(s) during the pendency of this application
☐ Charge fee(s) indicated below, **except for the filing fee**
to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Fee ($)	Small Entity Fee Code	Fee ($)	Fee Description	Fee Paid
1011	300	2011	150	Utility filing fee	
1012	200	2012	100	Design filing fee	
1013	200	2013	100	Plant filing fee	
1014	300	2014	150	Reissue filing fee	
1005	200	2005	100	Provisional filing fee	

SUBTOTAL (1) ($) 0

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

			Extra Claims		Fee from below		Fee Paid
Total Claims		-20 ** =	0	X		=	0
Independent Claims		-3 ** =	0	X		=	0
Multiple Dependent						=	0

Large Entity Fee Code	Fee ($)	Small Entity Fee Code	Fee ($)	Fee Description
1202	50	2202	25	Claims in excess of 20
1201	200	2201	100	Independent claims in excess of 3
1203	360	2203	180	Multiple dependent claim, if not paid
1204	200	2204	100	** Reissue independent claims over original patent
1205	50	2205	25	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

***or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Fee ($)	Small Entity Fee Code	Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet.	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	120	2251	60	Extension for reply within first month	
1252	450	2252	225	Extension for reply within second month	450
1253	1020	2253	510	Extension for reply within third month	
1254	1,590	2254	795	Extension for reply within fourth month	
1255	2,160	2255	1080	Extension for reply within fifth month	
1401	500	2401	250	Notice of Appeal	
1402	500	2402	250	Filing a brief in support of an appeal	500
1403	1000	2403	500	Request for oral hearing	
1452	500	2452	250	Petition to revive – unavoidable	
1453	1500	2453	750	Petition to revive – unintentional	
1501	1400	2501	700	Utility issue fee (or reissue)	
1502	800	2502	400	Design issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17 (q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	790	2809	395	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	790	2810	395	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	790	2801	395	Request for Continued Examination (RCE)	

Other fee (specify) ____

*Reduced by Basic Filing Fee Paid **SUBTOTAL (3)** ($)950

4. SEARCH/EXAMINATION FEES

Large Entity Fee Code	Fee ($)	Small Entity Fee Code	Fee ($)	Fee Description	Fee Paid
1111	500	2111	250	Utility Search Fee	
1112	100	2112	50	Design Search Fee	
1113	300	2113	150	Plant Search Fee	
1114	500	2114	250	Reissue Search Fee	
1311	200	2311	100	Utility Examination Fee	
1312	130	2312	65	Design Examination Fee	
1313	160	2313	80	Plant Examination Fee	
1314	600	2314	300	Reissue Examination Fee	

SUBTOTAL (4) ($)0

SUBMITTED BY Complete *(if applicable)*

Name (Print/Type)	Gary D. Yacura	*Registration No. (Attorney/Agent)*	35,416	*Telephone*	703-668-8000
Signature				*Date*	July 14, 2005

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PATENT

IN THE U.S. PATENT AND TRADEMARK OFFICE

Appellants: Hisham S. Abdel-Ghaffer

Application No.: 09/764,072

Art Unit: 2115

Filed: January 19, 2001

Examiner: Mark A. Connolly

For: A METHOD OF DETERMINING A TIME OFFSET ESTIMATE BETWEEN A CENTRAL NODE AND A SECONDARY NODE

Attorney Docket No.: 29250-000502/US

Customer Service Window
Randolph Building
401 Dulany Street
Alexandria, VA 22313
Mail Stop Appeal Brief – Patent

July 14, 2005

APPELLANTS' BRIEF ON APPEAL UNDER 37 C.F.R. §41.37

Sir:

In accordance with the provisions of 37 C.F.R. §41.37, Appellants submit the following:

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is Lucent Technologies.

II. RELATED APPEALS AND INTERFERENCES

There are no known appeals or interferences that will affect, be directly affected by, or have a bearing on the Board's decision in this Appeal.

III. STATUS OF CLAIMS

Claims 1-11 are pending in the application, with claims 1 and 11 being written in independent form.

Claims 1-4, 7 and 11 remain finally rejected under 35 U.S.C. § 102 (b) as being anticipated by Premerlani (US Patent No. 5,958,060).

Claims 5-6 and 8-10 remain finally rejected under 35 U.S.C. § 103 (a) as being unpatentable over Premerlani in view of Thornberg (US Patent No. 5,757,772).

Claims 1-11 are being appealed.

IV. STATUS OF AMENDMENTS

No Amendments have been entered.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention is directed to a method of determining a time offset estimate between a central node and a secondary node. Clock synchronization is a problem in distributed networks.[1] If different nodes in the distributed network are not synchronized (i.e., timing references at the nodes are not identical), it may be difficult to synchronize both of the nodes to a common reference (e.g., Coordinated Universal Time (UTC)).[2]

The inventors teach a method of determining a time offset estimate between a central node and a secondary node. A periodic timer includes a counter which starts at an initial value (e.g., 0) and counts up at equal increments until the counter reaches a threshold (e.g., 4095), at which point a next increment resets the counter to the initial value, where the resetting of the counter is referred to as a time wraparound.[3] Thus, at any given value of the periodic timer, the periodic timer will arrive again at the given number after a number of increments or counts equal to the threshold. Periodic timing will now be further discussed with respect to Figure 2.

[1] See Page 1, lines 11-12 of the Specification.
[2] See Page 1, lines 13-17 of the Specification.
[3] See Page 3, lines 5-19 of the Specification.

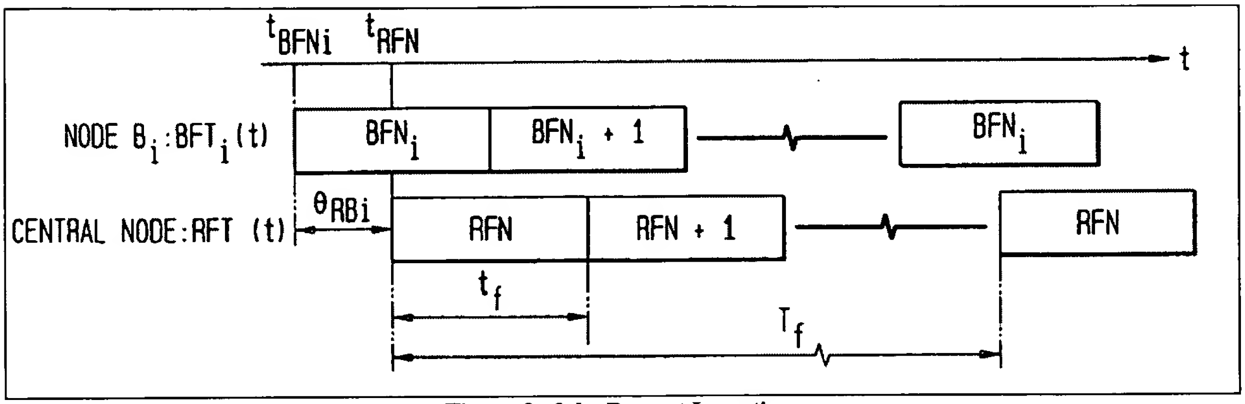

Figure 2 of the Present Invention

In the example embodiment of Figure 2 (reproduced above), the local timings of the central node R and the secondary nodes B_i's are periodic in modulo T_f format and the associated central node Frame Number (RFN) and node B_i Frame Number (BFN_i) are also periodic integers in modulo T_f format (i.e., RFN, BFN_i = 0, 1, ..., 4095 in 3GPP).[4] Accordingly, the central frame node time RFT and the node B_i frame time BFT_i hold to the following expressions:

$RFT\ (t + T_f) = RFT\ (t)$

$BFT_i\ (t + T_f) = BFT_i(t)$[5]

As disclosed on page 5 of the Specification, a time offset between a central node and a secondary node may arise because of uncoordinated system start times, intentional or accidental system restarts and/or a frequency drift during normal operation.[6] The time offset between the central node and the secondary node may be less accurate if a time wraparound occurs at the periodic counter at either the central node or the secondary node.[7]

---

[4] See Page 3, lines 20-23 of the Specification.
[5] See Equations (1) and (2) on Page 3 of the Specification.
[6] See Page 5, lines 13-26 of the Specification.
[7] See Page 2, lines 3-12 of the Specification.

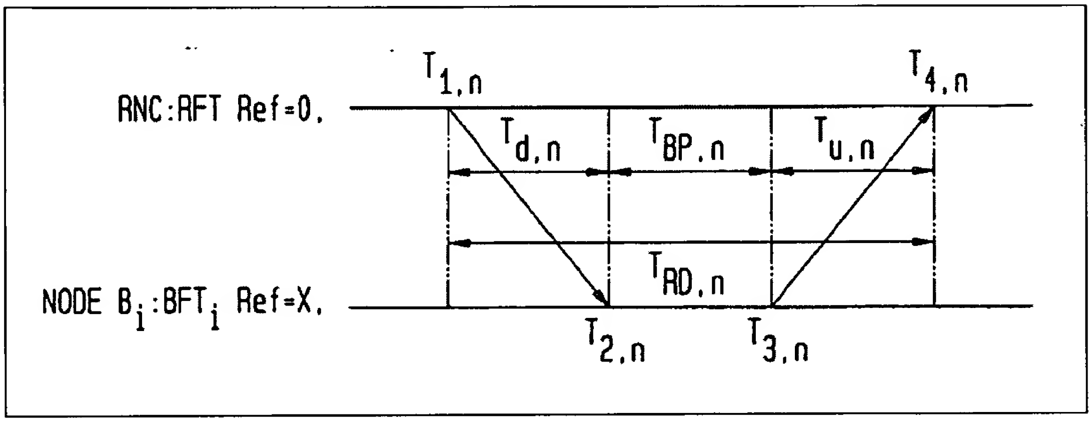

Figure 3 of the Present Invention

The method of estimating the time offset between the central node R and a secondary node B according to the claimed invention operates based on timing information measured at the central node R and the secondary node B.[8] One method for obtaining this timing information involves the sending of control frames between the central node R and the secondary node B.[9] As shown in Figure 3 (reproduced above) and described in steps S15-S30 of Figure 4A, the central node R sends a downlink (DL) node sync control frame stamped by RFT send epoch $\{T_{1,n}\}$.[10] Namely, the time $T_{1,n}$ is the local time at the central node R when the control frame is sent to the secondary node B.[11] The secondary node B receives that frame at BFT_i receive epoch $T_{2,n}$.[12] After certain secondary node B processing time T_{BP}, the secondary node B sends an uplink (UL) node sync control frame at BFT_i epoch $T_{3,n}$, where this frame is stamped by $\{T_{1,n}, T_{2,n}, T_{3,n}\}$.[13] Here, the times $T_{2,n}$ and $T_{3,n}$ are the local times measured at the secondary node B. When the central node R receives the UL node sync frame, it records the RFT receive epoch $T_{4,n}$.[14]

Once the central node R receives each of the times $t_{1,n}$ - $t_{4,n}$, a time wraparound adjustment (e.g., a conversion from a periodic to a continuous time scale) is executed (See step S35 in Figure 4A).[15] The time wraparound adjustment performed by the central node is illustrated in detail in Figure 5 (reproduced below).

[8] See Page 6, lines 14-17 of the Specification.
[9] See Page 6, lines 17-18 of the Specification.
[10] See Page 6, lines 19-27 of the Specification.
[11] *Id.*
[12] *Id.*
[13] *Id.*
[14] See Page 6, lines 20-27 of the Specification.
[15] See Page 8, lines 17-19 of the Specification.

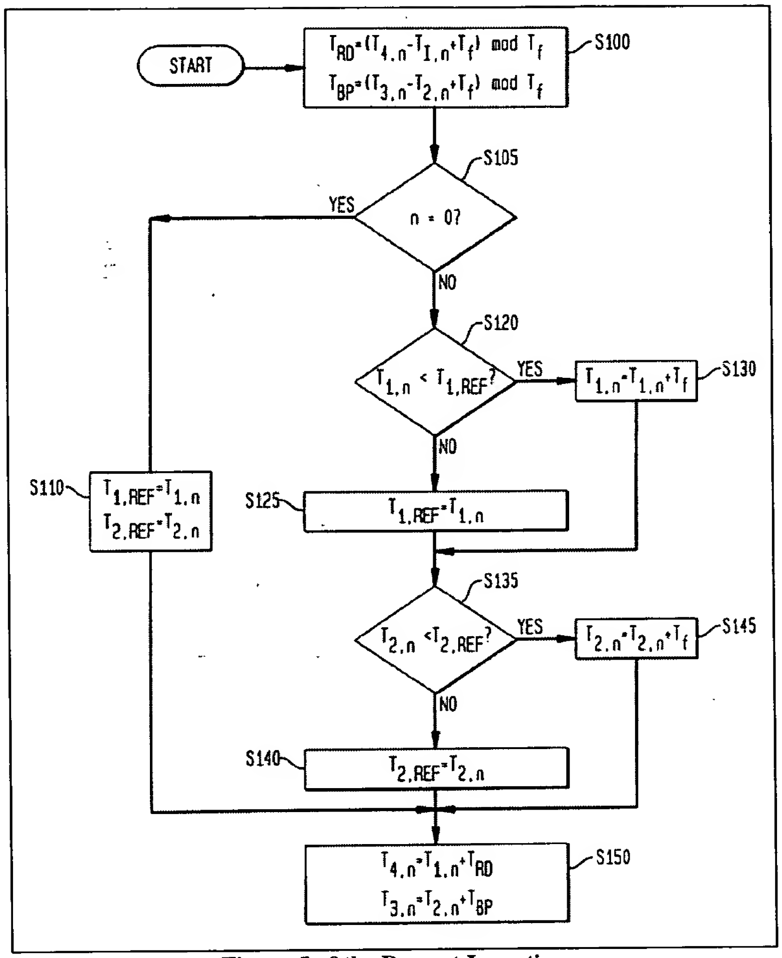

Figure 5 of the Present Invention

As shown in Fig. 5, in step S100, the central node R calculates the total round trip delay T_{RD} and the secondary node processing time T_{BP}, compensated for time wraparound by use of the "mod" calculation.[16] Subsequently, in step S105, the central node R determines if the timing information represents a first sample.[17] If so, then in step S110, a reference first send time $T_{1,REF}$ and a reference first receive time $T_{2,REF}$ are set equal to the first send time $T_{1,n}$ and the first receive time $T_{2,n}$, respectively.[18]

However, processing proceeds to step S120 if, in step S105, the sample count n does not equal zero.[19] In step S120, the central node R determines if the first send time $T_{1,n}$ is less than the reference first send time $T_{1,REF}$.[20] If so, then time wraparound has occurred at the

[16] See Equations (8) and (9) on Page 7 of the Specification and Page 8, lines 19-22 of the Specification.
[17] See Page 8, lines 22-23 of the Specification.
[18] See Page 8, lines 23-25 of the Specification.
[19] See Page 8, lines 26-27 of the Specification.
[20] See Page 8, lines 27-28 of the Specification.

central node R, and in step S130, the first send time $T_{1,n}$ is changed to $T_{1,n} + T_f$.[21] This operation converts the first send time $T_{1,n}$ from a periodic time scale to a continuous time scale.[22] If the central node R does not determine that the first send time $T_{1,n}$ is less than the reference first send time $T_{1,REF}$ in step S120, then processing proceeds to step S125.[23] In step S125, the central node R sets the reference first send time $T_{1,REF}$ equal to the first send time $T_{1,n}$.[24]

After step S130 or step S125, processing proceeds to step S135.[25] In step S135 the central node R determines if the first receive time $T_{2,n}$ is less than the reference first receive time $T_{2,REF}$.[26] If so, then time wraparound has occurred at the secondary node B, and in step S145, the first receive time $T_{2,n}$ is changed to $T_{2,n} + T_f$.[27] This operation converts the first receive time $T_{2,n}$ from a periodic time scale to a continuous time scale.[28] If the central node R does not determine that the first receive time $T_{2,n}$ is less than the reference first receive time $T_{2,REF}$ in step S135, then processing proceeds to step S140.[29] In step S140, the central node R sets the reference first receive time $T_{2,REF}$ equal to the first send time $T_{2,n}$.[30]

After step S140 or step S145, processing proceeds to step S150.[31] In step S150, the second receive time $T_{4,n}$ is set equal to the first send time $T_{1,n}$ plus the total round-trip delay T_{RD} and the second send time $T_{3,n}$ is set equal to the first receive time $T_{2,n}$ plus the secondary node processing time T_{BP}.[32] Because the first send time $T_{1,n}$ and the first receive time $T_{2,n}$ have been compensated for time wraparound, setting the second send time $T_{3,n}$ and the second receive time $T_{4,n}$ in this manner likewise compensates for time wraparound.[33]

After the time wraparound adjustment, as above-described with respect to Figure 5 is executed, uplink $T_{u,n}$ and downlink $T_{u,n}$ delay indicators are determined according to steps S40-S55 in Figure 4A as shown by equations (10) and (11) reproduced below:

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[21] See Page 8, lines 28-29 of the Specification.
[22] See Page 8, lines 29-31 of the Specification.
[23] See Page 8, lines 31-32 of the Specification.
[24] See Page 8, line 32 to Page 9, line 2 of the Specification.
[25] See Page 9, line 3 of the Specification.
[26] See Page 9, lines 3-5 of the Specification.
[27] See Page 9, lines 5-6 of the Specification.
[28] See Page 9, lines 6-7 of the Specification.
[29] See Page 9, lines 7-9 of the Specification.
[30] See Page 9, lines 9-11 of the Specification.
[31] See Page 9, line 12 of the Specification.
[32] See Page 9, lines 12-15 of the Specification.
[33] See Page 9, lines 15-18 of the Specification.

$$\tau_{D,n} = (T_{2,n} - T_{1,n}) = T_{D,n} + X_i \qquad (10)$$

$$\tau_{U,n} = (T_{4,n} - T_{3,n}) = T_{U,n} - X_i \qquad (11)$$

where x_i represents the time offset.[34]

After having obtained a number of uplink and downlink delay indicator samples (see step S50 in Figure 4B which requires N samples before proceeding)[35], a minimum of each of the uplink and downlink delay indicators is determined in step S55 of Figure 4B.[36] Then , the time offset X_i is determined according to equation 13 below in step S60 of Figure 4B:

$$\hat{X}_i = \frac{1}{2}\left[\tau_{D,\min} - \tau_{U,\min}\right] \quad , \qquad \{\text{adjusted within } [-T_f/2, T_f/2) \qquad (13)$$ [37]

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Appellants seek the Board's review of the rejection of claims 1-4, 7 and 11 under 35 U.S.C. § 102 (b) as being anticipated by Premerlani and claims 5-6 and 8-10 under 35 U.S.C. § 103 (a) as being unpatentable over Premerlani in view of Thornberg.

VII. ARGUMENTS

A. Appellants traverse the rejection of claims 1-4, 7 and 11 under 35 U.S.C. § 102(b) as being anticipated by Premerlani.

Claims 1 and 11 are argued separately below with claims 1-4 and 7 rising and falling together.

i) Claim 1

In the final Office Action dated December 15, 2004, the Examiner relies substantially upon column 6, lines 14-34 of Premerlani in rejecting independent claim 1.[38] In the cited section, Premerlani discusses round trip delay. Premerlani discloses that round trip delay may be calculated by subtracting the measured delay between a first terminal and a second terminal from the measured delay between the second terminal and the first terminal.[39] The

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[34] See Page 9, lines 19-23 of the Specification and equations (10) and (11) on page 7 of the Specification.
[35] See Page 9, lines 22-25 of the Specification.
[36] See Page 9, lines 25-27 of the Specification.
[37] See Page 9, line 27 – Page 10, line 5 of the Specification.
[38] See Pages 2-3 of the December 15, 2004 Final Office Action.
[39] See Column 6, lines 13-34 of Premerlani.

clock offset is determined by adding the two delays between the first and second terminals and dividing by two.[40] Premerlani states that "the clock offset can be positive or negative if time stamps are unsigned numbers that wrap around".[41] Premerlani discloses that if a rollover or wraparound of any one of the time stamps occurs, a predetermined number may either be added or subtracted to/from the round trip delay and one-half the predetermined number may either be added or subtracted to/from the clock offset.[42]

Independent claim 1 recites "converting the received downlink and uplink timing information to a continuous time scale". Premerlani does not disclose converting the received downlink and uplink timing information to a continuous time scale. Rather, as discussed above, Premerlani compensates for time wraparound by subtracting or adding a predetermined number from the roundtrip delay.[43] The roundtrip delay.is calculated using unconverted downlink and uplink timing values.[44] If Premerlani were to convert the received downlink and uplink timing information into a continuous time scale, no adjustment to the round trip delay would be necessary.

Independent claim 1 further recites "determining a time offset estimate between the central node and the secondary node based on the converted downlink and uplink timing information". Since independent claim 1 recites that the time offset estimate is based on the converted downlink and uplink timing information, the time offset estimate does not require the above-described adjustment with the predetermined number of Premerlani.

As discussed above, the predetermined number in Premerlani may either be subtracted or added to the final calculated round trip delay or the clock offset, which indicates that the downlink and uplink timing information (the respective measured delays between the first and second terminals) is performed <u>after</u> the determination of the round trip delay and the clock offset. In contrast, independent claim 1 recites determining the time offset estimate "based on the converted downlink and uplink timing information". Thus, according to the claimed invention, no subtraction to compensate for time wraparound would be executed on the determined time offset estimate because the uplink and downlink timing information, used to calculate the time offset estimate, is already in the continuous time domain.

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[40] *Id.*
[41] *Id.*
[42] *Id.*
[43] *Id.*
[44] *Id.*

Therefore, Applicant respectfully submits that Premerlani cannot disclose or suggest determining time offset "based on the converted downlink and uplink timing information" as recited in independent claim 1. Rather, Premerlani discloses calculating the round trip delay and the clock offset with periodic time stamps and then performing a compensation for rollover.

As demonstrated above, independent claim 1 is not anticipated or rendered obvious to one skilled in the art by Premerlani.

ii) Claim 11

As discussed above with respect to independent claim 1, Premerlani discloses calculating the round trip delay and the clock offset using only periodic time stamps.[45] After the round trip delay and the clock offset are calculated, Premerlani discloses adjusting the round trip delay for time wraparound, <u>not the downlink and uplink timing information</u>.[46]

Thus, Premerlani cannot disclose or suggest "adjusting the received downlink and uplink timing information for time wraparound" as recited in independent claim 11. Likewise, it follows that Premerlani cannot disclose or suggest determining a time offset estimate "based on the adjusted downlink and uplink timing information" as recited in independent claim 11. Rather, as discussed above with respect to independent claim 1, it appears that the disclosure of Premerlani teaches calculating the round trip delay and the clock offset using only time stamps unadjusted for time wraparound and then executing a compensation for execution a time wraparound adjustment to the calculated round trip delay.

As demonstrated above, independent claim 11 is not anticipated or rendered obvious to one skilled in the art by Premerlani.

B. Appellants Traverse the Rejection of Claims 5-6 and 8-10 under 35 U.S.C. §103 (a) as being unpatentable over Premerlani in view of Thornberg

As discussed above, Premerlani does not anticipate or render claim 1 as obvious to one skilled in the art. However, the Examiner alleges that "Thornberg teaches calculating a plurality of uplink and downlink delays in order to find an average uplink and downlink delay".[47]

Thornberg discloses a method of packet switched radio channel traffic supervision.[48] Thornberg relates to estimating either the uplink or the downlink average data packet delays in a communications network.[49] Thornberg, however, discloses nothing related to converting

[45] *Id.*
[46] *Id.*
[47] See page 4 of the December 15, 2004 Final Office Action.
[48] See Abstract of Thornberg.
[49] *Id.*

the periodic delay into a continuous time scale.[50] Thus, even if the Examiner is correct in that "Thornberg teaches calculating a plurality of uplink and downlink delays in order to find an average uplink and downlink delay", Applicant respectfully submits that Thornberg is similarly deficient as is Premerlani as discussed above with respect to independent claim 1.[51] Therefore, Premerlani in view of Thornberg cannot render claim 1 as obvious to one skilled in the art.

As such, claims 5-6 and 8-10, dependent upon independent claim 1 are likewise allowable over the Premerlani in view of Thornberg at least for the reasons given above with respect to independent claim.

VIII. CONCLUSION

Appellants respectfully request the Board to reverse the Examiner's anticipation and/or obviousness rejection of claims 1-11.

The Commissioner is authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

HARNESS, DICKEY, & PIERCE, P.L.C.

By: ______________________

Gary D. Yacura, Reg. No. 35,416
P.O. Box 8910
Reston, Virginia 20195
(703) 668-8000

GDY/DAP/cdw

[50] *Id.*
[51] See page 4 of the December 15, 2004 Final Office Action.

CLAIMS APPENDIX

Claims 1-11 on Appeal

1. (Original) A method of determining a time offset estimate between a central node and a secondary node, comprising:

receiving, at a central node, downlink and uplink timing information from a secondary node, the downlink and uplink timing information based on a periodic timing scale, the downlink timing information representing timing information for communication from the central node to the secondary node and the uplink information representing timing information for communication from the secondary node to the central node;

converting the received downlink and uplink timing information to a continuous time scale; and

determining a time offset estimate between the central node and the secondary node based on the converted downlink and uplink timing information.

2. (Original) The method of claim 1, wherein the downlink information includes a first time measured at the central node of sending a downlink frame to the secondary node and a second time measured at the secondary node of receiving the downlink frame, and the uplink information includes a third time measured at the secondary node of sending an uplink frame.

3. (Original) The method of claim 2, further comprising:

measuring, at the central node, a fourth time of receiving the uplink frame; and wherein

the converting step converts the first, second, third and fourth times to a continuous time scale.

4. (Original) The method of claim 3, wherein the determining step comprises:

determining uplink and downlink delay indicators based on the converted first, second, third and fourth times; and

calculating the time offset estimate based on the uplink and downlink delay indicators.

5. (Original) The method of claim 4, wherein

the determining uplink and downlink delay indicators step is performed for a plurality of first, second, third and fourth time sets; and

the calculating step calculates the time offset estimate based on the plurality of uplink and downlink delay indicators.

6. (Original) The method of claim 5, wherein the calculating step comprises:

determining a minimum uplink delay indicator and a minimum downlink delay indicator from the plurality of uplink and downlink delay indicators; and

calculating the time offset estimate based on the minimum downlink delay indicator and the minimum uplink delay indicator.

7. (Original) The method of claim 1, further comprising:

sending a downlink frame to the secondary node, the downlink frame including a first time measured at the central node indicating when the downlink frame is sent; and wherein

the receiving step receives an uplink frame at the central node, the uplink frame includes the first time, a second time measured at the secondary node of receiving the downlink frame, a third time measured at the secondary node of sending the uplink frame.

8. (Original) The method of claim 1, further comprising:

setting a timer at a start of the method; and

stopping the method if the timer times out.

9. (Original) The method of claim 1, further comprising:

compensating the time offset estimate for DC bias errors.

10. (Original) The method of claim 1, wherein the central node is a radio network controller.

11. (Original) A method of determining a time offset estimate between a central node and a secondary node, comprising:

receiving, at a central node, downlink and uplink timing information from a secondary node, the downlink and uplink timing information based on a periodic timing scale, the downlink timing information representing timing information for communication from the central node to the secondary node and the uplink information representing timing information for communication from the secondary node to the central node;

adjusting the received downlink and uplink timing information for time wraparound; and

determining a time offset estimate between the central node and the secondary node based on the adjusted downlink and uplink timing information.